



# **Position Paper: Mechanical Tourniquets and Hemostatic Agents**

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# Mechanical Tourniquets and Hemostatic Agents

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Tourniquets have been used in treatment of traumatic extremity injuries for centuries. Uncontrolled hemorrhage can be a leading cause of preventable death in trauma patients. Several studies have shown a survival benefit with its use and low rates complications. Widespread tourniquet deployment is being seen in modern military systems. A review of civilian extremity trauma from 1994-99 noted that 86% of patients who died from an isolated exsanguinating penetrating limb injury had signs of life at the scene but had no discernible pulse or blood pressure upon arrival to the hospital <sup>1</sup>. Tourniquets application for extremity trauma is the standard of care for combat casualties <sup>2</sup>.

While there is data and experience to support its use in combat, there is a limited scientific data on its use in civilian EMS systems. Several studies showing benefit have been published on recent military tourniquet <sup>3 4</sup>. Another study confirmed the benefits and reported low rates of complications from tourniquets<sup>5</sup>. The current 6<sup>th</sup> edition of PHTLS endorses the use of mechanical tourniquets if external bleeding cannot be controlled by direct pressure.

## Tourniquet recommendations:

1. Prehospital tourniquets are indicated if direct pressure or a pressure dressing fails to control hemorrhage. Reinforcing dressings is a practice that should be discouraged as bleeding can continue disguised by layers of dressings.
2. Tourniquets should be placed on the proximal thigh as the femoral artery runs in a bony groove over the distal femur and tourniquets placed above the knee may not work. Similarly, tourniquets should be placed only on the upper arm. Advice to place a tourniquet as close to the injury as possible is incorrect.
3. Commercial tourniquets that feature a windlass device should be used.
4. Tourniquets should be placed as soon as possible after initial bleeding control measures have failed.

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<sup>1</sup> Dorlac WC, DeBakey ME, Holcomb JB, et al. Mortality from isolated civilian penetrating extremity injury. *Journal of Trauma*. 2005;59: 217-222.

<sup>2</sup> Prehospital Tourniquet Use – A review of the current literature PHTLS; Lance E. Stuke, M.D. MPH

<sup>3</sup> Beekley AC, Sebesta JA, Blackburne LH, et al. Prehospital tourniquet use in Operation Iraqi Freedom: Effect on hemorrhage control and outcomes. *Journal of Trauma*. 2008; 64: S28-S37

<sup>4</sup> Kragh JF, Littrel ML, Jones JA, et al. Battle casualty survival with emergency tourniquet use to stop limb bleeding. *Journal of Emergency Medicine*. 2009

<sup>5</sup> Kragh JF, Walters TJ, Baer DG, et al. Practical use of emergency tourniquets to stop bleeding in major limb trauma. *Journal of Trauma*. 2008;64: S38-S50

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5. If bleeding persists, place another tourniquet proximal to the initial tourniquet.
6. The time of tourniquet application should be documented and relayed to the trauma team upon arrival at the hospital.
7. Operational medical directors are encouraged to develop patient care and destination guidelines in consultation with the trauma centers.

Hemostatic agent recommendations:

There may be significant vascular injuries, such as in the inguinal region, in which mechanical tourniquets cannot be physically applied. A number of topical hemostatic agents are available on the market to mitigate major hemorrhage. A number of animal studies have demonstrated efficacy<sup>6 7</sup>. Some of these studies involved laceration of vascular structures in areas of the animal which restricted mechanical tourniquet placement. Human data is limited and mostly involves military combat casualties<sup>8 9</sup>. There is a paucity of literature on use of hemostatic agents in civilian injuries. There are no randomized controlled studies examining the benefits of adding topical hemostatic agents after failed direct pressure and/or mechanical tourniquets. Although the animal studies and military literature is compelling, additional research is needed to determine the benefits of topical hemostatic agents in non military combat applications.

1. There is a paucity of literature currently to demonstrate clinical benefit of topical hemostatic agents in civilian EMS systems. Topical hemostatic agents may be beneficial in controlling hemorrhage occurring in sites not controlled by tourniquet placement and in sites which tourniquets cannot be placed.
2. Operational medical directors are encouraged to develop protocols and destination guidelines in consultation with the trauma centers.

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<sup>6</sup> Burkatovskaya M, Tegos GP, Swietlik E, et al: 'Use of chitosan bandage to prevent fatal infections developing from highly contaminated wounds in mice. *Journal of Biomaterials Applications*. 27(22):4157-4164, 2006

<sup>7</sup> Arnaud F, Parreno-Sadalan D, Tomori T, et al. Comparison of 10 hemostatic dressings in a groin transaction model in swine. *J Trauma*. 2009;67:848-855

<sup>8</sup> Wedmore I, McManus JG, Pusateri AE, et al: 'A special report on the chitosan-based dressing: Experience in current combat operations. *Journal of Trauma*. 60(3):655-658, 2006.

<sup>9</sup> Achneck HE, Sileshi B, Jamiolkowski RM, et al. A comprehensive review of topical hemostatic agents: Efficacy and recommendations for use. *Annals of Surgery* 2010; 251: 217-228.